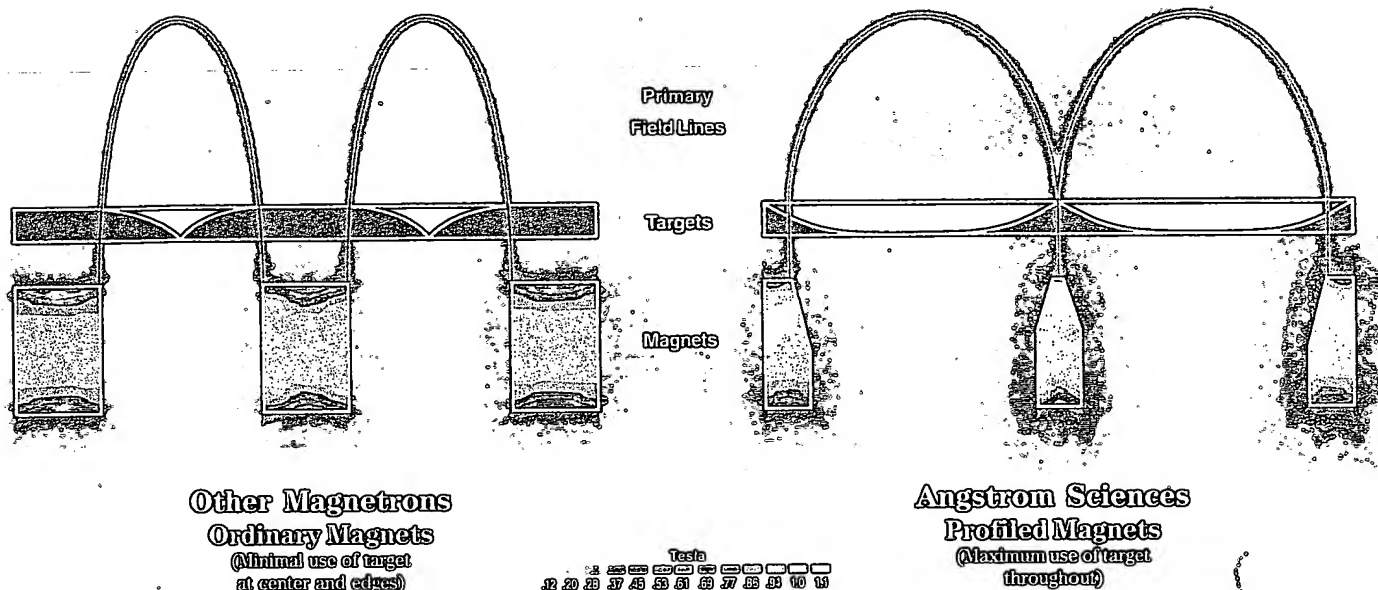


## The Advantage Of Profiled Magnets



## The Angstrom Advantages

### Greater Control

All reputable makers of magnetron sources use permanent rare-earth magnets to direct the flow of atoms during the sputtering process.

But that's where the similarity between their products and ours ends.

Because, to optimize performance for any application, you have to be able to control the *shape* of the magnetic field.

And even the most carefully calculated placement of conventional magnets can't do that as well as the advanced new method we've developed and patented.

### Profiled Magnets

Simply put, we *profile* our magnets.

That is, we grind them into contours which optimize the shape of the *field* they generate. Because, the shape of that field determines everything from film uniformity and deposition rate to target utilization.

This approach allows us to use computer modeling to match your application with the magnetic profile that will work best for you. We can even custom-engineer magnetics to meet your specific requirements.\*

### Optimized Performance

The result is, you get exactly the kind of performance you need — whether it's high uniformity and target utilization, high rate and throughput, or a perfect balance between the two.

And you get that performance in a state-of-the-art device that provides many other advantages as well (including the option of balanced or unbalanced magnetron fields).

### More Efficient Cooling

*Turbulent* water flow is another advance we've pioneered, patented, and built into every one of our magnetrons.

It's superior to old-fashioned laminar water flow because it distributes cooling more evenly across the cathode, to help minimize "hot spots" and eliminate both gain boundary dissociation and cracking of thermally sensitive materials.

### Faster, Easier Target Change

Angstrom Sciences magnetrons also incorporate our patented threaded target clamping system, which helps minimize downtime by providing the fastest, easiest method available for changing targets (plus, it adjusts to variable target thickness without extra tools or devices).

### Stronger Magnetrons & Magnets

Unlike most manufacturers, we machine each of our standard magnetrons out of solid blocks of 304 stainless steel and OFHC copper. And we use NdFeB magnets — which are 30% more powerful than other rare-earth magnets. So you can count on getting maximum magnetic integrity, encased in the most robust precision-fitted assembly you can buy.

### More Comprehensive Service

Angstrom Sciences designs, engineers, and manufactures a complete line of sputtering sources for everything from research and development to full-scale production applications.

And we offer a comprehensive array of targets, evaporation materials, backing plates, and bonding techniques, too.

But we also pride ourselves on the ability to rise to any occasion. So if you don't find what you're looking for in our literature, please don't hesitate to call.

We'll be happy to work with you, to help you incorporate the latest advances in magnetron technology into your own sputtering applications.

\*Note: Some manufacturers try to achieve similar results by installing *secondary* magnets to alter the shape of the field. That method not only costs more to manufacture, but provides less flexibility than profiling, and generates stray field lines which reduce uniformity.

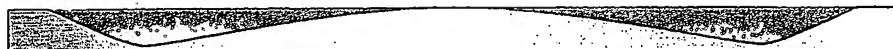
## The New Standard Of The Industry

### More Advanced, And More Efficient

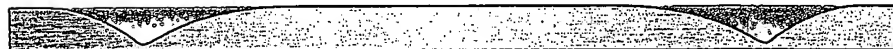
Angstrom Sciences circular magnetrons have become recognized as the new standard of the sputtering industry.

Because in addition to their advanced features — such as profiled magnets, turbulent water flow, and solid stainless steel construction — they offer a host of other performance advantages as well.

### Examples Of 3" Circular Target Erosion



Angstrom Sciences Magnetron



Ordinary Magnetron

### Versatile, Compact Design

Their ultra-compact design makes them ideal for virtually any new or retrofit application — including the most complex multiple-cathode deposition clusters or the smallest vacuum chambers. And they are available configured for either internal or external mounts.

### Total Power Compatibility

Their low-impedance heads provide RF, DC, mid-frequency DC, pulsed DC, and microwave power compatibility.

### Standard Fittings

Angstrom Sciences uses ISO NW standard fittings, as well as ConFlat® metal seal flanges. All utilities are maintained at atmosphere, and are accessed through standard "O"-ring compression fittings for ease of installation in any vacuum system.

### Full Range Of Sizes

Angstrom Sciences circular magnetron sources are available in 1", 2", 3", 4", 5", 6", 8", 10", 12", and 16" target sizes.

### Quick, Easy Target Change

Our patented threaded clamp and anode shield allow you to change targets (sizes 1" to 6") quickly and easily without specialized tools. And their built-in adjustability lets you fit targets of varying thickness without resorting to spacing devices.

### Lower Pressure, Higher Power

Our cathodes can operate at extremely low pressure — down to the  $10^{-4}$  Torr range — and our directly-cooled designs can deliver power densities up to 250 watts/in<sup>2</sup> (39 watts/cm<sup>2</sup>).

### Higher Rates And Performance

That means you can coat a substrate faster with Angstrom Sciences magnetrons.

So you can maximize both your coating zone and your target utilization without the kind of trade-off in rate that other magnetrons force you to make.

### Greater Target Utilization

Yet these same advanced magnetrons can give you target utilization typically in the range of 40%.

### Greater Uniformity

And, thanks to our patented profiled magnets, our magnetrons also deliver much greater uniformity of deposition — routinely in the  $\pm 3$ -to-5% range.

(One of our research customers has even documented uniformity of  $\pm .1\%$  with Angstrom Sciences magnetrons.)

# rectangular magnetrons

## Expanding Horizons

As more and more industries discover the speed, controllability, and bottom-line benefits of magnetron sputtering, production professionals are reaching out for ways to apply these advantages to larger, faster manufacturing processes.

## Broader Solutions

For many, particularly those who have to coat broad physical substrates or achieve extremely high throughput, *rectangular* magnetrons offer the perfect solution.

## Growing Applications

That's why use of rectangular magnetrons is growing so rapidly in industries such as:

- Aerospace
- Architectural Glass
- Authentication
- Automotive
- Decorative Coating
- Defense
- Flat Panel Displays
- Magnetic Storage Media
- Medical/Dental
- Optical
- Packaging
- Semiconductors/Microelectronics
- Solar
- Wear-Resistant Coating

**New  
Capacity  
For  
Production**

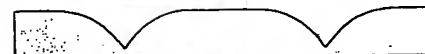
## Shaping The Future

And that's also why Angstrom Sciences is reshaping the future of sputtering technology with a complete line of rectangular magnetrons for every application.

## Examples Of 4" Wide Rectangular Target Erosion



Angstrom Sciences Magnetron



Ordinary Magnetron

## Patented Advantages

Just like our circular magnetrons, Angstrom Sciences rectangular magnetrons incorporate our patented profiled magnets, turbulent water flow, solid stainless steel construction, and fully-encased NdFeB rare earth magnets.

And, naturally, they also feature industry-standard fittings, total power-supply compatibility, and internal and external mounting options.

## Rectangular Magnetron Performance\*

RECTANGULAR TARGETS			
TARGET WIDTH	ANGSTROM SCIENCES	OTHER DESIGNS	UNEQUALITY
1.5"	43%	—	±5%
3.5"	44%	22%	±5%
4"	46%	21%	±5%
5"	47%	22%	±5%
6"	47%	23%	±5%
8"	46%	23%	±5%
12"	45%	22%	±5%

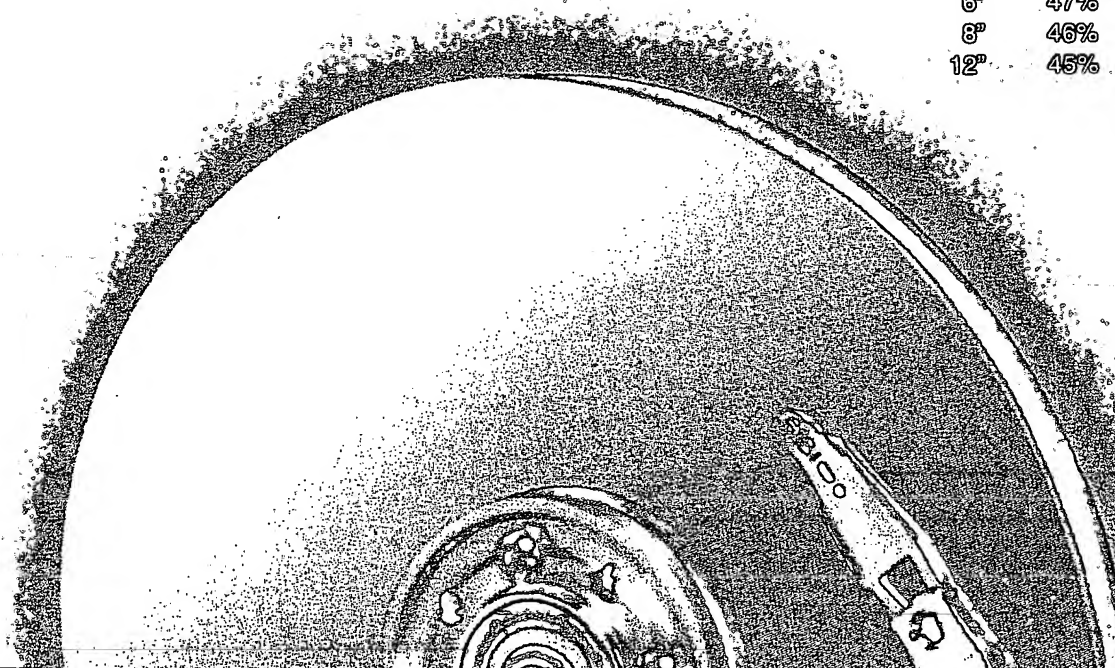
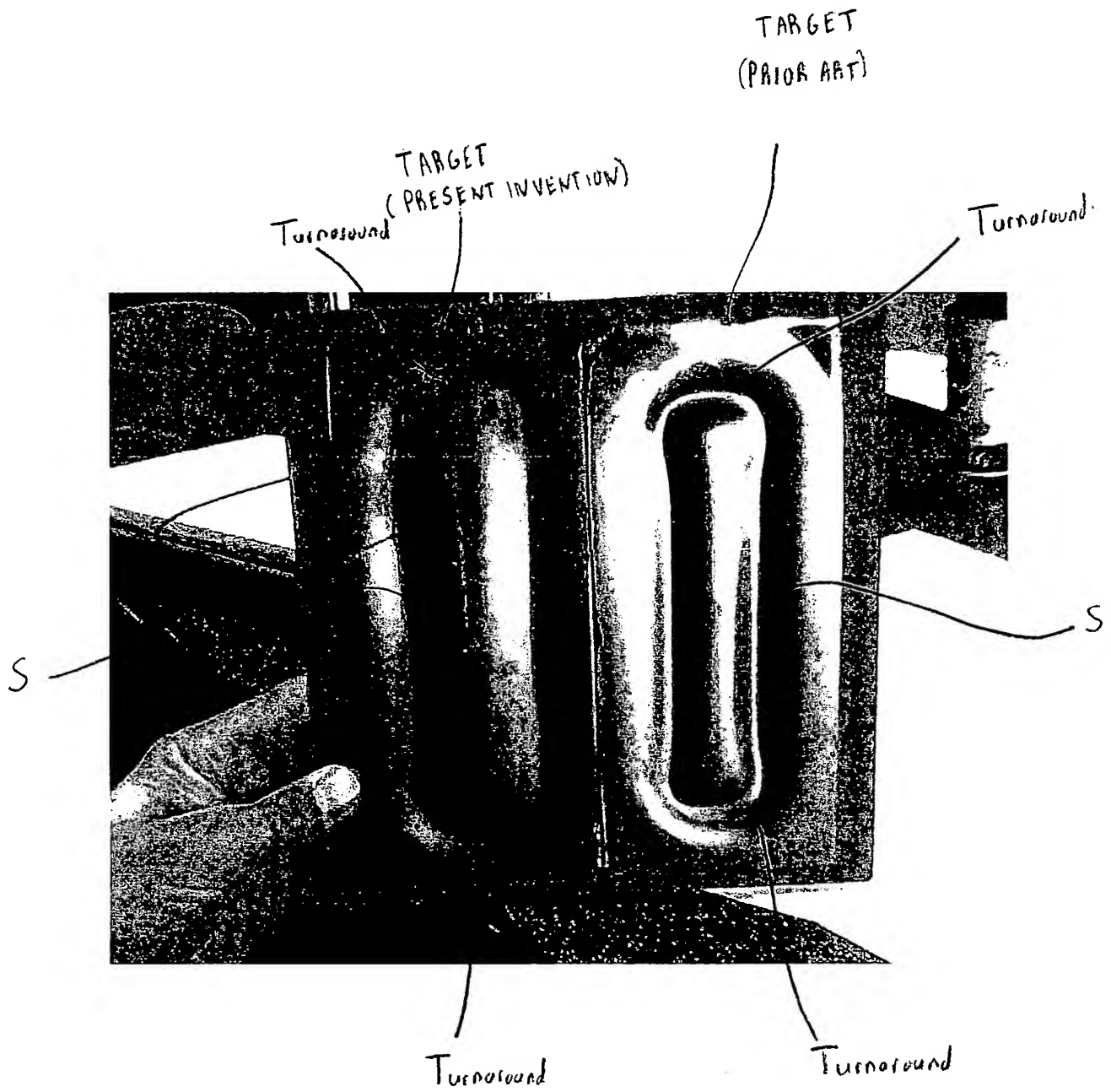


Exhibit B



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